Roads Innovation Task Force

March 24, 2016

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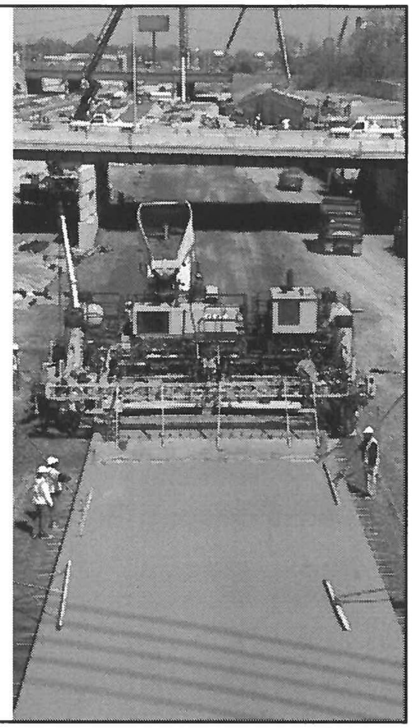
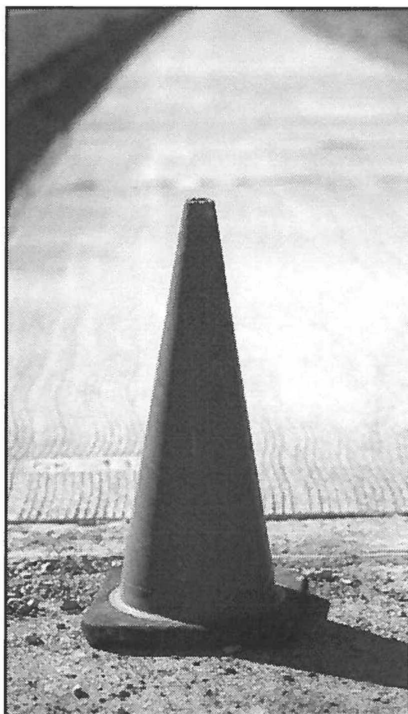
Michigan Department of Transportation





Public Act 175 of 2015

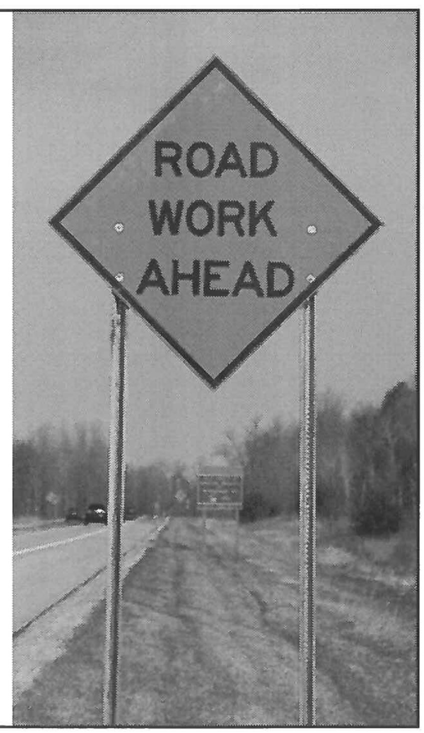
- Requires establishment of MDOT Roads Innovation Task Force (RITF)
- Requires RITF to produce comprehensive public report with specific requirements
- Release of funds after concurrent House & Senate resolution

Comprehensive Public Report

- Evaluates road materials & construction methods
- Focuses on materials that may cost more in up-front spending but produce life-cycle savings
- Strives to achieve a reduction of at least 50% in net present value 50-year life-cycle costs
- Focuses on longer-term time frames that maximize value to taxpayers on total cost basis
- Includes a plan to achieve these targets

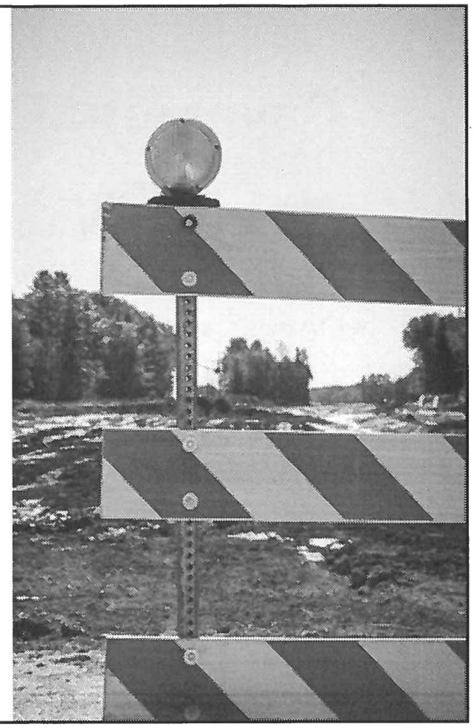
Roads Innovation Fund

- Sets aside $100 million annually until one-time concurrent resolution is passed by Legislature
- Money is then released through the Act 51 formula – four way split:
  - 10% to CTF
  - 39.1% to Counties
  - 21.8% to Cities/Villages
  - 39.1% to State Trunkline Fund

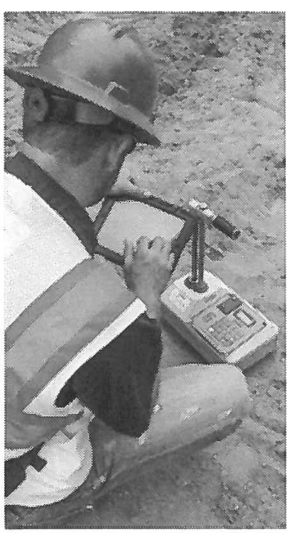


RITF Report

Three Major Sections in Report
- Evaluation of Materials & Processes
- Up-Front Investment to Reduce Life-Cycle Costs
- Longer-Term Time Frames
- Available at: www.michigan.gov/mdot



Evaluation of Materials & Processes



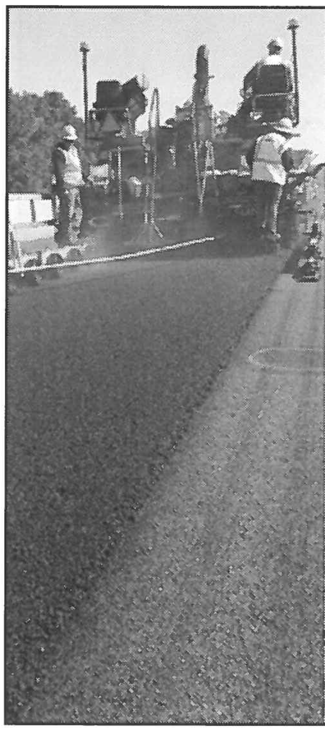
Vision Statement

MDOT will be recognized as a progressive & innovative agency with an exceptional workforce that inspires public confidence.

Tools Used for Evaluation
- New Materials Evaluation Procedure
- Pavement Demonstration Program
- Research Findings & Results
- National & International Studies

Pavement Demonstration & Research

- European Pavement Project
- HMA Perpetual Pavement
- Concrete White Topping
- Strategic Highway Research Program (SHRP)
- Long-Term Pavement Performance Program (LTPP)

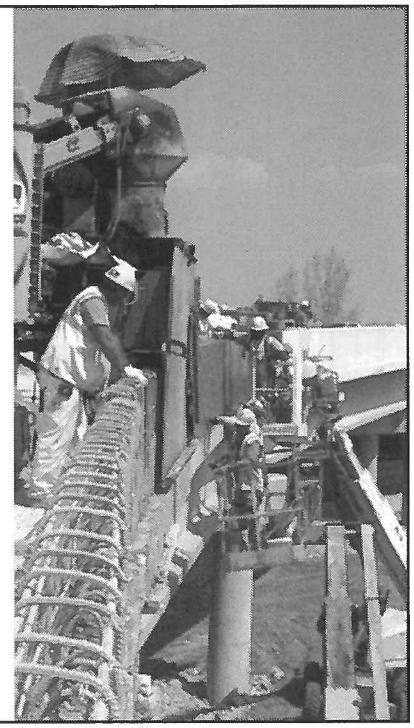


Pavement Innovations

- Use of warm mix asphalt
- Permissive use of recycled rubber in hot mix asphalt
- Allowance to use recycled asphalt shingles
- Longitudinal joint density specification
- Alkali silica reactivity (ASR) mitigation measures required for Portland cement concrete pavements
- Precast concrete pavement repairs to reduce mobility impacts
- Rapid set concrete pavement repairs to accelerate opening to traffic
- Stringless paving

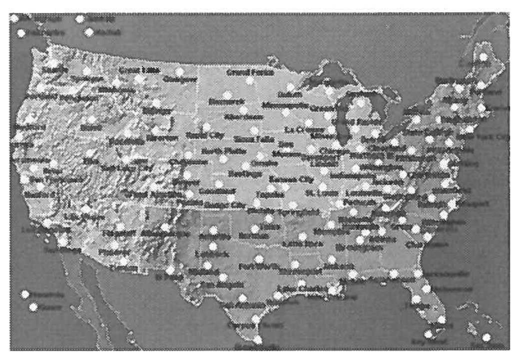
Up-Front Investment to Reduce Life-Cycle Costs

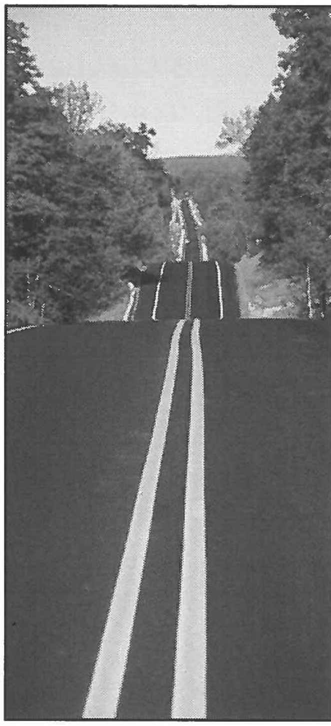
- No existing, proven maintenance-free pavement section
- Pavement management approach supported by Transportation Asset Management Council
- Solicited input on long-life pavements
- Noted potential pavement enhancements (long-life pavements)



National Perspective

- MDOT reached out to national experts:
  - Other DOTs
  - Universities
  - National & State Contracting Associations
  - National Pavement Experts



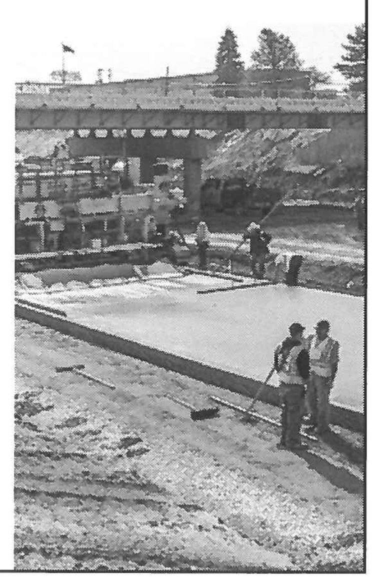


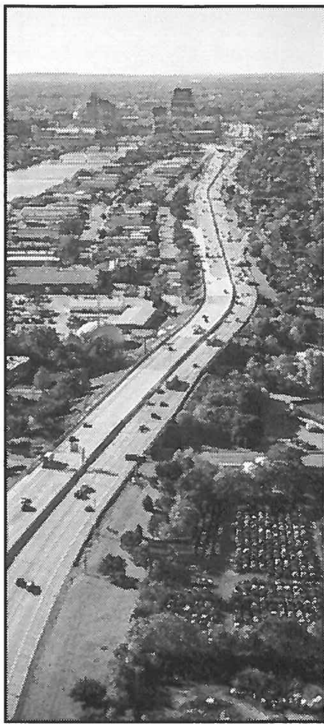
Hot Mix Asphalt (HMA) Improvements
(Long-Life Pavements)

- Mechanistic-Empirical Pavement Design Guide
  - Long-lasting HMA base
  - Renewable HMA surface
- Increased overall base/subbase thickness
- Enhanced:
  - Material requirements
  - Acceptance specifications
  - Construction requirements
  - Drainage requirements
- No utilities within roadbed
- Prohibit studded tires

Portland Cement Concrete Improvements
(Long-Life Pavements)

- Mechanistic-Empirical Pavement Design
- Jointed Plain Concrete Pavement (50-year service life) & Continuously Reinforced Concrete Pavement (75-year service life)
- Increased overall base/subbase thickness
- Enhanced:
  - Material requirements
  - Acceptance specifications
  - Construction requirements
  - Drainage requirements
- No utilities within roadbed
- Prohibit studded tires





Long-Life Pavement Costs

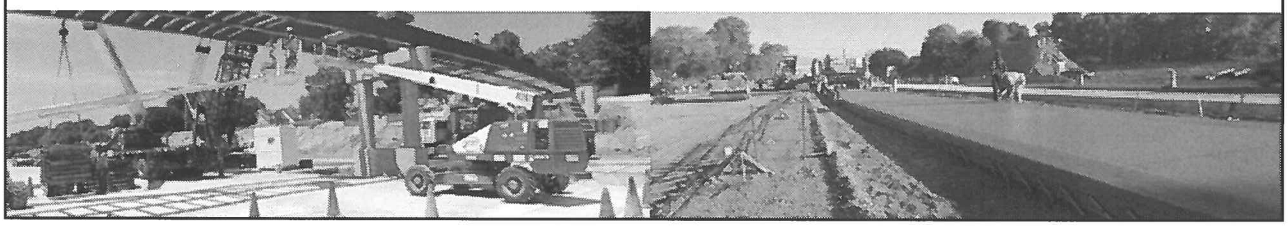
- Estimates based on:
  - Increased material costs
  - Increased pavement structure depth for 30- & 50-year design life
  - Enhanced acceptance & construction requirements
  - Potential utility & real estate acquisitions
- Each project is unique & may significantly increase costs (ROW, bridges, safety upgrades, utility relocations, etc.)

Pavement Costs

	20-Year Design Life (Current Standard)*	30-Year Design Life (50-Year Service Life)	50-Year Design Life (75-Year Service Life)
Estimated reconstruction cost per lane mile	$2M	$3.7M	$4.7M

Evaluating Potential Costs

In order to evaluate potential up-front investment for reducing life-cycle costs, a network analysis was performed to identify potential cost-savings.



Potential Per Lane Mile Life-Cycle Cost Savings From Utilizing Enhanced Reconstruction Design Standards

50-Year Outlook: Potential Per Lane Mile Life-Cycle Cost Savings From Enhanced Reconstruction Design Standards			
	20-Year Design (Avg. 35-Year Service Life) (Current Standard)	30-Year Design (50-Year Service Life)	50-Year Design (75-Year Service Life)
2016 Reconstruction Cost/Lane Mile	$2,000,000	$3,700,000	$4,700,000
50-Year Life-Cycle Cost/Lane Mile	$8,164,750	$4,231,500	$5,410,000
50-Year Life-Cycle Cost Savings/Lane Mile		$3,933,250	$2,754,750
Additional Lane Miles of Rehabilitation Work from 50-Year Life-Cycle Cost Savings/Lane Mile of Initial Reconstruction		1.7*	1.2*
2016 Lane Miles Reconstructed from $300 million/yr. Investment in Long Life Pavements	150	81	64
Total Additional Lane Miles of Rehabilitation Work from 50-Year Life-Cycle Cost Savings	N/A	138	77

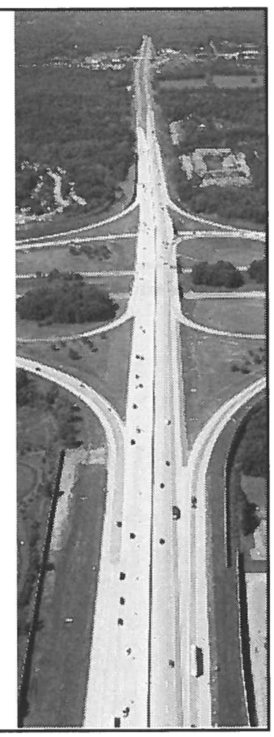
***Additional rehabilitation work from cost-savings was calculated using a 50-year, inflation-adjusted average costs of $2.3 million per lane mile.**

Network Analysis

- Road Quality Forecasting System (RQFS) was used to perform analysis
- RQFS incorporates projected future inflation into modeling
- Some construction materials may inflate at different rates depending on national & international economic growth
- Primary materials (cement & petroleum products) have additional influences that may not trend with standard inflation rates
- Inflation rate for analysis: 4-4.5% is used for first six years & 4% is used thereafter

MDOT's 20-Year Current Meet & Sustain Strategy

- MDOT designs pavements for 20-year design life with service life of 33 to 37 years (based on historical in-service pavements)
- 90% good/fair pavement condition goal as approved by STC
- Based on "mix of fixes" of reconstruction, rehabilitation & capital preventive maintenance
  - Accepted nationally as most cost-effective way to maintain pavement network

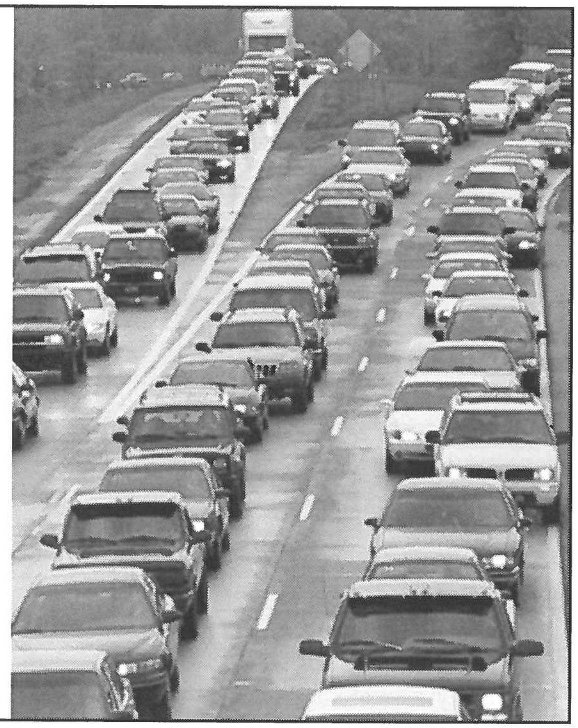


Roads Innovation Goals

- No state highways in "poor condition"
- Reduce life-cycle costs by 50%
- Implement long-life pavement designs

And…

- Analysis performed on scenario of an additional $300 million/year investment for long-life pavement projects



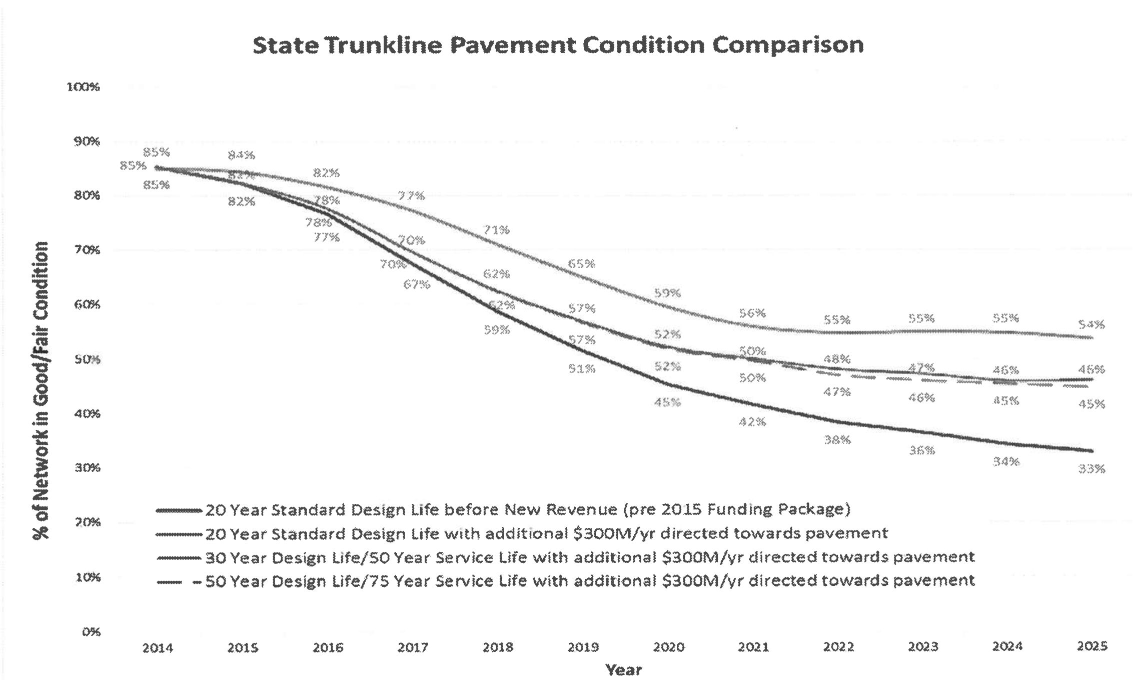
The Cost of Long-Life Pavement

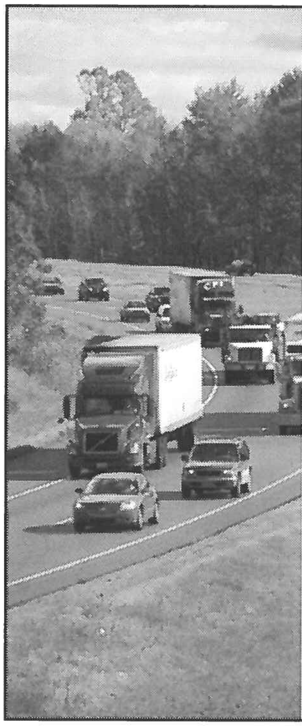
	20-Year Design Life (Current Standard)*	30-Year Design Life (50-Year Service Life)	50-Year Design Life (75-Year Service Life)
Estimated reconstruction cost per lane mile	$2M	$3.7M	$4.7M
Estimated initial investment (first 10 years)	$15B	$111B	$140B
Estimated 50-year costs	$170B	$129B	$163B

*Based on STC goal of 90% Good/Fair

How Much More Per Year?

Strategy	Annual Investment Needed First 10 Years	Additional Average Investment Needed Next 40 Years	Investment Needed to Maintain Condition Goal for Next 50 Years
20-Year Current Meet & Sustain	$15B or $1.5B/year	$3.9B/year	$170B or $3.4B/year
30-Year Design Standards (50-Year Service Life)	$111B or $11B/year	$450M/year	$129B or $2.6B/year
50-Year Design Standards (75-Year Service Life)	$140B or $14B/year	$560M/year	$163B or $3.3B/Year





Longer-Term Time Frames

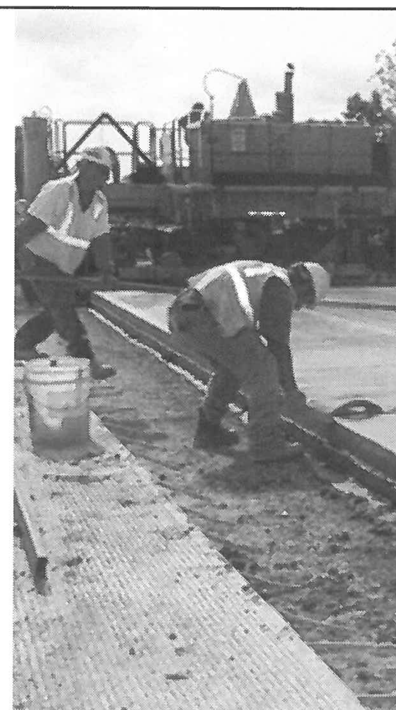
Improvements to HMA Pavements

- Regression of air voids to 3% to get more asphalt cement in mixture
- Implemented longitudinal joint density specification
- Only allow fine-graded mixes for top courses
- Use of softer binders for preventive maintenance projects
- Performed HMA Peer Review – reviewing recommendations for implementation
  - Acceptance specifications
  - Construction practices
  - Mix design practices

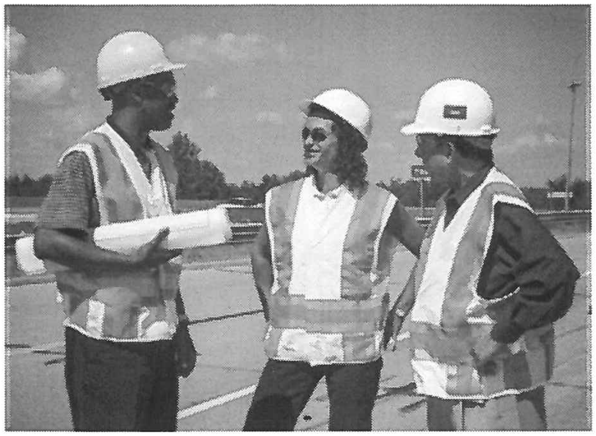
Longer-Term Time Frames

Improvements to Concrete Pavements

- Reduce cementitious content requirements
- Well-graded aggregate mixes
- Use of supplemental cements
- Air content quality testing
- Use of wear-resistant epoxy coating on load transfer dowels
- Concrete permeability testing – resistivity
- Curing requirements



Longer-Term Time Frames



- Continue to seek new materials, technologies & construction methods
- Utilize existing tools
- Adopt new tools & methods as they become available
- Incorporate actual performance data into analysis as it becomes available

We can build Michigan pavements that last 50 to 75 years…

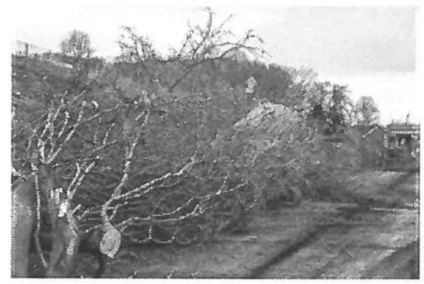
Savings can be recognized in future years. But…

Up-front costs will be substantial, too.

How costly?

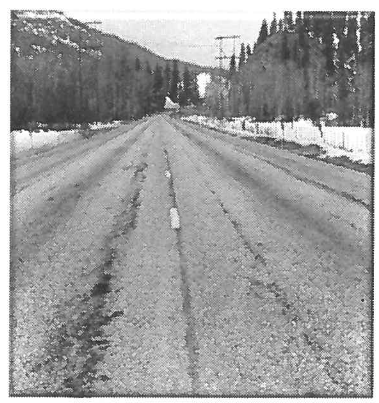
Unanswered Questions

- Will today's drivers pay $1.70/gallon in additional state gas tax to build a new road system to reduce future costs?
- Will we tolerate the building & tree removal needed for wider grades?
- Will the experimental designs really perform?
- Will roads designed in 2015 be adequate in 2065?



Necessary Legislative Changes

- Changes to life-cycle cost analysis law
- Statewide prohibition on use of studded tires
- Beneficial use of recycled materials vs. long-term performance



Questions?

MDOT

Better.*Faster*.Cheaper.Safer.Smarter